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ABSTRACT

A practicum addressed the inability of fourth-grade students to successfully solve mathematics word problems due to poor comprehension of and negative attitude toward problem solving. A problem solving improvement program designed primarily around the writing process used in language arts instruction was implemented. The steps of this process include pre-writing, writing, conference, revision, and publication. A student-created mathematics game was an end product of the program. Direct instruction and fun activities on the various properties of word problems, organizing information, determining relevance, and drawing conclusions was also a component of the program. Lessons were designed to be of high interest and fun, helping to create a more positive attitude toward problem solving. Results indicated increased levels of achievement and positive affective changes for the target group of 25 students. (One table of data is included. Appendixes include the pretest and posttest, the word problem attitude survey, and student data. Sample student assignments are attached.) (Author/SR)

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WORD PROBLEMS: COMPREHENDING THE PROBLEM IN FOURTH GRADE

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by

Janice K. Doby

A Practicum Report

Submitted to the Faculty of the Center for the Advancement of Education, Nova University, in partial fulfillment of the requirements for the degree of Master of Science.

The abstract of this report may be placed in a National Database System for reference.

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Abstract

Word Problems: Comprehending the Problem in Fourth Grade.
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Descriptors: Elementary Education/ Mathematics/ Word Problems/ Comprehension/ Critical Thinking/ Cooperative Learning/ Fourth Grade/

The inability of fourth grade students to successfully solve word problems due to poor comprehension of and negative attitude toward problem solving was addressed by this practicum. A problem solving improvement program designed primarily around the writing process used in language arts instruction was implemented. The steps of this process include pre-writing, writing, conference, revision, and publication. A student created mathematics game was an end product of the program. Direct instruction and fun activities on the various properties of word problems, organizing information, determining relevance, and drawing conclusions was also a component of the program. The lessons were designed to be of high interest and fun, helping to create a more positive attitude toward problem solving. The results indicate increased levels of achievement for the target group. Students in the target group demonstrated positive affective changes as well. It was concluded that the direct instruction and activities and the writing process provide a vehicle to facilitate and increase problem solving comprehension and achievement. Appendices include the pretest and posttest, the word problem attitude survey, and student data. An attachment to the practicum provides sample student assignments.

Authorship Statement

I hereby testify that this paper and the work it reports are entirely my own. When it has been necessary to draw from the work of others, published or unpublished, I have acknowledged such work in accordance with accepted scholarly and editorial practice. I give this testimony freely, out of respect for the scholarship of other professionals in the field and in the hope that my own work, presented here, will earn similar respect.

Signed: Janice K. Doby

Janice K. Doby

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CHAPTER I

Purpose

The school under study was located in the western section of a southern coastal city. It was situated in the center of a relatively new upper middle class community which houses both retired persons and young professional families. Many parents were actively involved in volunteer groups and the parent-teacher organization.

The kindergarten through fifth grade school facility was constructed in 1989 as a replacement for an existing school, with an intended capacity of 710 students. The first year in operation, the school had a student population high of 990, requiring the addition of portables and temporary use of the media center facilities as classrooms. The 1990-1991 school year saw an increase in population to 1,191, and the current school year opened with 1,259 students.

Students in the school come primarily from low middle to upper middle class socio-economic backgrounds, with approximately 40 percent of the students on free or reduced lunch programs. The current ethnic make-up of

the student population was approximately 54 percent White, 36 percent Black, seven percent Hispanic, and three percent Asian or Indian.

The organization of the school was divided into primary and intermediate divisions. The school staff consisted of one principal, two assistant principals, 67 regular teachers, eight special education teachers, and one drop-out prevention teacher. Support personnel included a guidance counselor, two media specialists, and 28 teacher assistants.

The author of the practicum has been a music teacher at the school, working with all grade levels, for ten years. The writer has also assisted classroom teachers with state and county testing, as well as individual testing in various subject areas. A cooperative working relationship is maintained between the author and the classroom teachers. The author had two flexible periods within the weekly schedule in which to implement the program with the targeted students.

The school follows a unified curriculum which is mandated by the county. Grading procedures also follow a county scale, but are adjusted in various ways by the individual grade levels. Grades are reported at the end

of each of four 9-week periods.

Fourth grade students are instructed in seven subject areas in the regular classroom: mathematics, science, reading, spelling, social studies, language arts, and health. Students receive subject grades of A, B, C, D, and F. It is required that students pass all subject area mastery tests in order to be promoted to the next grade level.

The development of the skills necessary to solving word problems is significantly important in the study of mathematics. However, many students have difficulty mastering those skills. Word problems are an integral part of the elementary mathematics program and are, therefore, a major factor in a student's ability to pass the mastery tests in this subject area.

Problem solving, or word problems, has long been a subject of educational research. The primary purpose for teaching mathematics is to help students learn how to solve problems (Wright and Stevens 1983). Applying mathematical knowledge to real-world situations requires both an understanding of mathematical facts and the ability to comprehend the relationships among objects and the situations described in a given problem

(Englert, Culatta, and Horn 1987). Word problems have traditionally been an integral part of elementary mathematics education textbooks. They have also traditionally been difficult to teach and difficult for students to do (Burns 1986).

A survey was developed by the author to determine, from the personal experience and observation of intermediate classroom teachers, if solving word problems was a major difficulty for their students, and if so, why (Appendix A:30). The results of the survey (Appendix B:32) indicated that 100 percent of the teachers responding found solving word problems to pose the most difficulty for their students. Eighty-seven percent of those responding stated that comprehension of the problem was the major reason for the difficulty the students experience. Further, 87 percent of the teachers believed that a negative student attitude toward word prolms is, or could be, a factor.

Many students have a negative attitude toward word problems, and many teachers feel frustration and discouragement in helping their students learn how to solve such problems (Ford 1990). Number-related problems can generate a high level of annoyance and

frustration (Paine 1984). Many students, when faced with word problems, become angry or develop a sense of defeat. The stubborn phenomenon of failure in learning this discipline is particularly disconcerting given that mathematics figures prominently in modern life. Mathematics phobia sometimes starts as early as the first grade, and for some people it never ends (Nesher 1986).

A word problem survey (Appendix C:34) was administered to 135 fourth grade students which pertained to their attitudes and opinions concerning word problems. The results of the survey indicated that 60 percent of the students had a negative attitude toward word problems. Seventy-six percent of the students indicated that the word problems they do at school have little or no relationship to handling problems in the "real world". Ninety-three percent of the students surveyed stated that word problems are either moderately difficult or very difficult. Finally, the survey results indicated that 60 percent of the students lack an understanding of how to solve word problems (Appendix D:36).

The same 135 fourth grade students were later given a word problem test (Appendix E:38) involving 15 one-step

problems in addition, subtraction, multiplication, and division. The results of the test indicated that 36 percent of the students scored 80 percent or better, while 64 percent of the students scored lower than 80 percent (Appendix F:42). If this had been a mastery test in mathematics, the 64 percent of the students who scored below 80 percent on this test would have failed. Students are required to pass mathematics mastery tests with a score of 80 percent or better.

The deficiency in problem solving skills was further demonstrated by the results of the mathematics subtests of the California Test of Basic Skills (CTBS) for the past two years. The fourth grade score on the Mathematics Concepts and Applications subtest for 1990 was the 54th percentile. In 1991, the fourth grade score on the same subtest was the 50th percentile. The national median for all subtests of the CTBS is the 50th percentile. It should be noted that these scores include all fourth grade students who were tested in those two years (Appendix G:44).

The target group was selected based on the results of the pre-implementation word problem survey (Appendix H:46) and word problem test pretest

(Appendix I:48). The results on these two instruments were similar to those of the entire group of fourth grade students pretested. The target group and the total group both showed 64 percent of the students tested scoring below 80 percent on the word problem test pretest.

The problem to be addressed was the inability exhibited by fourth grade students to successfully solve word problems. Problem solving deficiencies result in lowered grades, possible summer school, or even grade retention. This deficiency also contributes to a negative attitude toward mathematics in general, and word problems in particular.

The students in the target group were exposed to a systematic problem solving improvement program, and the author anticipated 80 percent of the students to show at least a 20 percent improvement in their score on the word problem test (Appendix J:50). The author also expected to see an improvement in the students' ability to think critically through solving word problems. A more positive attitude toward word problems was also expected to be fostered.

There was a definite need to develop a unique, systematic problem solving program to help students be

successful in mathematics. Fourth grade teachers (Appendix K:54) and the school administrator (Appendix L:57) agreed that there was a need to develop an innovative approach and supported the development of a problem solving improvement program.

The purpose of this program was to help fourth grade students improve problem solving and critical thinking skills, and to develop a more positive attitude toward problem solving. Over a 12 week period the author provided fun physical and written activities and instruction on the various properties of word problems, organizing information, determining relevance, drawing conclusions, and the writing process. Eighty percent of the students in the target group were expected to demonstrate a 20 percent improvement in their ability to solve word problems. Improvement was measured by comparing the arithmetic mean of the pretest administered during pre-implementation and the posttest at the end of the implementation period.

Over the 12 week period students in the target group were to demonstrate improvement in critical thinking skills in the areas of organizing information, determining relevance, and drawing appropriate

conclusions through participation in the problem solving improvement program. Improvement was measured by monitoring the quality of the classwork completed and teacher observation. It was further anticipated that the target group would show an improved attitude toward word problems as measured by the word problem survey administered during pre-implementation and at the end of the practicum project.

CHAPTER II

Research and Solution Strategy

"Unquestionably, reading, writing, and mathematics are viewed as the 'basic' skills components of the elementary school curriculum" (Pellegrino and Goldman, 1987:23). It is generally agreed that problem solving is important for effective mathematical performance, yet it is one of the most difficult areas to teach in elementary school mathematics. Knifong and Burton (1985) state that teaching students to think logically about solving word problems is at the very center of the responsibility of mathematics teachers.

The most cited factor thought to cause students to fail at solving word problems is the ability to comprehend the problem. It seems that though students may be able to read the words very well, they don't understand what they are reading (Knifong and Burton 1985). Nesher (1986:1119) suggests that word problems "...should be treated as a special textual genre that requires a special interpretation in mathematical contexts."

Yancey, Thompson, and Yancey (1989) designed a study to determine if fourth graders would improve their

problem solving skills if they were taught how to draw their own diagrams when solving word problems. Most of the hours spent in diagramming instruction were devoted to tabular diagramming because the majority of word problems are tabular problems. The authors in this study reported that such instruction was very effective in helping a group of fourth graders perform better in solving word problems in mathematics because the students are able to not only read the problem, but also to see the problem.

> As I peruse math materials, I have the distinct feeling that there's a formidable faction of problem creators who take fiendish delight in stumping potential solvers--without helping them learn anything in the process. (Paine 1984:33)

Paine (1984) suggests that word problems are often more like riddles than mathematics problems. The following six suggestions were proposed for demystifying problem solving: (1) save the tricky puzzles for special times; (2) children should be taught that there are other ways to approach word problems than simply to read it again; (3) creative problem solving should be encouraged; (4) "guess-and-test" problem solving should be supported; (5) full advantage should be taken of opportunities to solve real-life problems as they arise in the classroom; (6) problem solvers should be given ample time to solve

the problems.

The standard procedures generally learned in school often do not make sense in everyday situations outside of school which involve mathematics. Problem solving outside of school usually is sustained by the fact that the contexts in which problems are surrounded make sense to the problem solver. Therefore, the individual is able to apply informal knowledge to a problem which has developed from direct experience. Also, in the everyday world, people often use mathematical procedures and thinking processes that are very different from those learned in school (Lester 1989).

School mathematics often has little resemblance to the types of problems with which people are confronted in out-of-school settings. A comparison of in-school and out-of-school contexts indicates that people perform better in everyday situations largely because it is much easier to make sense out of everyday situations than schoollike situations. Lave (1988), as cited by Lester (1989:34), indicates that the process of making sense of a situation is closely linked to five factors generally found in out-of-school contexts: (1) it typically takes place in a familiar setting; (2) it is often dilemma

driven; (3) it is often goal directed; (4) it is in children's own natural language, and therefore more personalized and meaningful to them; and (5) it is commonly the result of the problem solver's having observed the skills as well as the thinking involved in expert performance.

Lester (1989) recommends that teachers not rely totally on the textbook as the source of problems. Rather, ask students to create their own word problems that are then solved by their classmates. This will provide sets of problems containing familiar settings and which are stated in the students' own language. It is also suggested that teachers encourage their students to solve problems in more than one way and to share their approaches with each other.

The word problems in many mathematics textbooks do not create any personal interest for students. Smith (1989) suggests that children should be involved in creating problems so that they are personalized, interesting, and funny. The problems should appeal to students' natural sense of the ridiculous and their love for exaggeration. Such an approach helps to create a more positive attitude toward word problems, and the

skills the students learn can then be applied to word problems in textbooks and on tests. The more interested a student is in the mathematics class, the better they focus their energies on mathematics.

Wright and Stevens (1983) recommend taking the language experience approach to problem solving. This provides students an opportunity to write problems using their own personal experiences and their own everyday language. A problem solving unit about a visit to a theme park was presented by these authors. The following are the procedures used in developing the unit: (1) an interest inventory was administered to select the topic of common interest; (2) brochures from the theme park were displayed; (3) the students and teacher discussed the theme park; (4) the students wrote a group experience story to read to other children; (5) the class developed guidelines for good problems; (6) the students wrote and exchanged problems about the theme park; and (7) follow-up activities were designed for the problem solving unit. Wright and Stevens did not offer the specific results of the project undertaken, however, the implication was that it was quite successful. The authors did state that the vocabulary

of some students was enriched. Further, the importance of clarity of expression and proofreading became apparent to these children.

The task of developing problem solving skills is similar to producing better writers and better thinkers because problem solving, like writing, is a process. It is essential to guide students through the processes of problem solving if they are to become better problem solvers. Students can become better thinkers by using their own language in developing problems to be solved (Ford 1990). Ford suggests that the key is to use the same strategies that are effective in process focused writing instruction.

There are five stages in the writing process: (1) "prewriting"--the teacher provides a stimulus for writing; (2) "writing"--the students write down their thoughts and ideas; (3) "conference"--a peer listens to what the writer is saying and gives feedback on the content of what has been written; (4) "revision"--the students focus their ideas, clarify their writing, and add or delete information; and (5) "publication"--the students put their work into a final form for others to read (Ford 1990). Using the writing process as a

strategy helps students focus on the question being asked, look for important information, and become familiar with the structure of word problems.

Though the suggestions made by researchers concerning improvement of problem solving skills vary, there is one constant theme which appears frequently in the literature. The theme is that students should be involved in the creation of problems to be solved, thus making the problems more relevant and interesting to the students. When students create their own problems, they develop a sense of ownership of the work to be completed.

After reviewing literature on improving problem solving skills, the ideas of Ford (1990) seemed especially helpful. By using the writing process, students may develop better cognitive skills and a better attitude toward word problems. The development of group problem solving activities based on classroom opportunities (Paine 1984) has been incorporated in the author's problem solving program. The idea Smith proposes of making problem solving fun was also an important concept to consider. By making problem solving fun, students were more apt to complete the assignments and actually gain understanding from completion.

Currently, the fourth grade classroom teachers primarily use the materials provided in the mathematics textbooks for teaching word problem skills. These textbooks generally give instruction on a particular mathematics operation. After students complete several sets of numerical exercises, they are presented with a collection of word problems at the end of the chapter. Fourth grade teachers also use a county mandated supplementary word problem workbook.

An innovative program using an eclectic approach was developed. Components of the program include direct instruction on problem solving skills, group and individual fun activities, and the writing process. Students were instructed on the various properties of word problems, organizing information, determining relevance, drawing conclusions, and the writing process. The students also produced a word problem game which will be kept in their mathematics center for future use.

CHAPTER III

Method

The implementation of the problem solving improvement program consisted of three components. The three components are the following: (1) teacher instruction; (2) group and individual physical and written activities designed to make problem solving fun; and (3) the writing process with a student created end product for the mathematics center. The components provided the students with the opportunity to improve their skills at solving word problems, develop better critical thinking skills, work cooperatively with peers, and develop a more positive attitude toward problem solving.

Teacher instruction and guidance were interspersed throughout the entire twelve week program. The author met with the target group for 30-minute periods twice a week in the author's classroom. During the course of the program, the students were instructed on the various properties of word problems, organizing information, determining relevance, drawing conclusions, and the writing process. The lessons were designed to be of

high interest and fun.

Instruction during week one was limited to an introduction to the program through three physical group activities and one individual activity. Students were divided into groups of three or four for the group activities. For the first activity, the learning groups were assigned the task of figuring the total number of buttons its members were wearing. The students then found the average number of buttons per student in their groups. In the second activity the students were asked to measure their foot length and body height, then they were to find how many foot lengths it takes to equal their height. (Most students were six or seven of their own feet tall.) The third activity asked the question, which is a better buy--two for a nickel or three for a dime? The students discussed this in their groups and then reported back. The individual activity was a set of word problems, designed and prepared on computer by the author, about strange concoctions which used the first names of students in the target group (see Attachments).

During weeks two, three, and four instruction focused on recognizing the properties of word problems,

thinking through the problem, and determining reasonable answers. Students worked individually on exercises requiring them to recognize the properties of word problems, choose reasonable facts and answers, fill in missing information, make up the question, and write the problem for given facts and answers (see Attachments). Again the word problems provided used the first names of students in the target group. The author guided and assisted students with these activities.

Instruction during weeks five through ten was given on applying the writing process to word problems. The steps in the writing process included (1) prewriting, (2) writing, (3) conference, (4) revising and editing, and (5) publication. During the second meeting of each week of implementation, the author collected the students' work to evaluate it in terms of quality and to determine if the students were properly on task. The author also conducted a brief question and answer period at the end of each week to further determine student progress and understanding. When it was deemed necessary during implementation, the writer elaborated on the previous instruction given in the area of difficulty, and provided individual assistance prior to

moving on to the next stage of the practicum.

Week five focused on the prewriting stage. Students were given menus and catalogs from local businesses and asked to think about a situation in which they might be dining at one of the restaurants or shopping at one of the stores. The students were given an example problem which they were not to solve, but rather asked to think about situations in which they might be involved that are similar to the example. This concluded the prewriting stage, and the students were asked to write a word problem. The students began the writing stage in the sixth week by writing out their own ideas on yellow ledger paper. The yellow paper served as a reminder that they were not writing a finished copy. When the students finished writing, they read over their own work and performed the calculations before moving into the next stage. During week seven, the students moved into pairs for the conference stage. They were asked to read each other's problems to see if they made sense, and to work out the problems to see if the problems were workable. They were also reminded to discuss with each other what they thought about the problems. The author walked around the room listening and intervened only when necessary.

The comments received from their conference stage made revising and editing during week eight an easy task. Students made corrections on their problems and were then ready to put their word problems into final form. For the publication stage in weeks nine and ten, the students created a word problem game. The problems they had written were neatly copied onto blank index cards which were used to accompany a mathematics gameboard created by the group during week 10. The game has become part of their mathematics center.

For week 11, duplicate copies of the students' game were provided for the students to play. This gave the students an opportunity to solve their classmates' problems. It also served as an opportunity to test the game they created.

During week 12 the program was summarized with the target group. The word problem survey (Appendix C:34) and the posttest (Appendix J:50) were administered at this time. The results were made available to the target group's classroom teacher and the observer.

CHAPTER IV

Results

The primary purpose of the program was to help fourth grade students to improve their skills in solving word problems. It was also expected that the students in the target group would improve their critical thinking skills in the areas of organizing information, determining relevance, and drawing appropriate conclusions through participation in the problem solving improvement program. Further, the program was designed to create a more positive attitude toward problem solving.

Table 1 displays the data for the scores of the target group on the word problem test pretest (Appendix E:38) and posttest (Appendix J:50). The pretest and posttest were identical consisting of 15 one-step word problems including addition, subtraction, multiplication, and division. It was anticipated that 80 percent of the students participating in the practicum project would demonstrate a 20 percent improvement in their ability to solve word problems. Improvement was measured by comparing the arithmetic mean

of the lower 80 percent of the target group (students 6-25) on the pretest with the same group on the posttest. The mean score of this group on the pretest was 51.7 percent, while the mean score on the posttest was 79.25 percent. The results indicate that 80 percent of the target group demonstrated a mean increase of 27.55 percent. It may be noted here that the mean score of the entire target group increased by 22.52 percent.

Table 1

Comparison of Target Group Pretest and Posttest Scores

Student	Pretest	Posttest	Percentage Increase
1	100	100	
2	100	100	
3	100	100	
4	87	93	6
5	87	93	6
6	87	100	13
7	87	93	6
8	80	93	13
9	80	93	13
10	73	87	14
11	73	93	20
12	67	100	33
13	60	80	20
14	60	73	13
15	47	93	46
16	47	100	53
17	40	93	53
18	33	93	60
19	33	60	27
20	33	47	14
21	33	67	34
22	27	33	6
23	27	53	26
24	27	67	40
25	20	67	47

The results of the target group word problem survey (Appendix H:46) administered prior to and at the end of implementation indicate a more positive attitude toward problem solving after the practicum intervention. There was a 44 percent decrease in the number of students who dislike word problems and a 32 percent increase in the number of students who like them. After implementation, there was a 12 percent increase in the number of students who thought that school word problems help them solve "real world" problems. The number of students who believed word problems to be easy increased by four percent, while those who believed word problems to be very difficult decreased by 24 percent. Finally, the survey results indicate a 28 percent reduction in the number of students who state that they do not understand how to solve word problems.

During the course of implementation, the development of improved critical thinking skills was promoted. The direct instruction and group and individual activities were designed with this intention. The author observed that the target group improved in the areas of organizing information, determining relevance, and drawing appropriate conclusions. This was demonstrated

in the quality of the students' work, questions, and the students' collaborative efforts as the implementation progressed.

In conclusion, the results of the practicum program suggest that the intervention strategies employed assisted fourth grade students in improving their problem solving skills. It further suggests that making problem solving fun and utilizing the writing process also improves students' attitudes toward problem solving. Finally, the development of critical thinking skills is essential in assisting students in their comprehension of word problems.

CHAPTER V

Recommendations

Teaching problem solving is not a task which is unique to teachers of fourth grade students. The strategies utilized in this practicum having been successful in improving problem solving skills with fourth grade students, the author will share the results with other teachers of intermediate grade levels. The strategies employed could remain in tact while the individual teachers might choose to modify the content. The results will also be shared with the school administration and any interested person. The author will offer to provide an in-service workshop summarizing the project at the school. Further, the writer will give copies of the practicum abstract to the administration, intermediate grade level chairpersons, the media specialist, and the area mathematics specialist.

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APPENDIX A

Teachers' Mathematics Survey

APPENDIX A

TEACHERS' MATH SURVEY

DIRECTIONS: Please read the four questions below. Circle the answer that best describes your personal experience in teaching math.

1. Which of the following poses the most difficulty for your students?

   A. Mastery of math facts
   B. Computation skills
   C. Solving word problems

2. Which of the following do you perceive to be the most common problem causing students to have difficulty with word problems?

   A. Computational skills
   B. Comprehension of the problem
   C. Negative attitude toward word problems

3. Is student attitude a factor in their difficulty with word problems?

   A. Yes
   B. Possibly
   C. No

4. Would you be interested in a program aimed at improving student skills in solving word problems?

   A. Yes
   B. Possibly
   C. No

APPENDIX B

Teachers' Mathematics Survey Results

Appendix B

Teachers' Mathematics Survey Results

		# of Responses	%
1.	Which of the following poses the most difficulty for your students?		
	A. Mastery of math facts	0	0%
	B. Computation skills	0	0%
	C. Solving word problems	15	100%
2.	Which of the following do you perceive to be the most common problem causing students to have difficulty with word problems?		
	A. Computation skills	0	0%
	B. Comprehension of the problem	13	87%
	C. Negative attitude toward word problems	2	13%
3.	Is student attitude a factor in their difficulty with word problems?		
	A. Yes	7	47%
	B. Possibly	6	40%
	C. No	2	13%
4.	Would you be interested in a program aimed at improving student skills in solving word problems?		
	A. Yes	14	93%
	B. Possibly	1	7%
	C. No	0	0%

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APPENDIX C

Word Problem Survey

APPENDIX C

WORD PROBLEM SURVEY

DIRECTIONS: Read the four questions below. Circle the answer that best describes how you feel about math word problems. Remember, your name does not have to be written on this survey.

1. How do you feel about word problems?

   A. I like them
   B. I don't have any special opinion about them
   C. I hate them

2. Do you think that word problems you do at school help you to handle problems in the "real world"?

   A. Yes
   B. Sometimes
   C. No

3. Word problems are. . .

   A. Easy
   B. A little hard
   C. Very hard

4. I don't understand how to work word problems.

   A. True
   B. Sometimes true
   C. False

APPENDIX D

Word Problem Survey Results

APPENDIX D

Word Problem Survey Results

	# of Students	%
1. How do you feel about word problems?		
A. I like them	12	9%
B. I don't have any special opinion about them	42	31%
C. I hate them	81	60%
2. Do you think that word problems you do at school help you to handle problems in the "real world"?		
A. Yes	33	24%
B. Sometimes	36	27%
C. No	66	49%
3. Word problems are..		
A. Easy	9	7%
B. A little hard	54	40%
C. Very hard	72	53%
4. I don't understand how to work word problems.		
A. True	45	33%
B. Sometimes true	36	27%
C. False	54	40%

APPENDIX E

Word Problem Test
Pretest

WORD PROBLEM TEST

Pretest

1. Shawn, Billy, and Tina collect rocks. Shawn has 243 rocks. Billy has 512 rocks. Tina has 106 rocks. How many rocks do they have in all?

   A. 618 rocks
   B. 851 rocks
   C. 860 rocks
   D. 861 rocks

2. Jim took a trip. The first day he traveled 146 miles. The second day he traveled 322 miles and the third day he traveled 213 miles. How many miles did he travel in three days?

   A. 468 miles
   B. 535 miles
   C. 681 miles
   D. 6,711 miles

3. Sherri had $20.00 to spend on Christmas presents. She wanted to buy presents for her mother and father and her two sisters. If she spent the same amount on each one, how much money could she spend on each present?

   A. $ 4.00
   B. $ 5.00
   C. $80.00
   D. $ 9.00

4. A school has 758 students. If 264 students go on a field trip, how many students are still in school?

   A. 494 students
   B. 514 students
   C. 594 students
   D. 1,022 students

5. There are 8 classrooms. Each classroom has 32 desks. How many desks are there in all?

   A. 40 desks
   B. 246 desks
   C. 256 desks
   D. 326 desks

6. The store sold 564 cases of cherries the first week. The second week the store sold 325 cases of cherries. How many more cases were sold the first week than the second week?

   A. 889 cases
   B. 249 cases
   C. 241 cases
   D. 239 cases

7. George, Jack, and Ivan are on a bowling team. George scored 218 points. Jack scored 226 points and Ivan scored 206 points. What was their total score?

   A. 432 points
   B. 444 points
   C. 632 points
   D. 650 points

8. Lorenzo collects butterflies. He puts 24 butterflies in each glass case. If he has 7 glass cases, how many butterflies are in Lorenzo's collection?

   A. 168 butterflies
   B. 148 butterflies
   C. 94 butterflies
   D. 31 butterflies

9. Justin has 42 photos. If he could put 6 photos on each page of his album, how many pages could he fill?

   A. 7 pages
   B. 48 pages
   C. 36 pages
   D. 13 pages

10. Jackie has a stamp collection. On each page of her book she can put 36 stamps. In her new stamp book she has filled 4 pages. How many stamps are in her new stamp book?

   A. 204 stamps
   B. 144 stamps
   C. 124 stamps
   D. 114 stamps

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11. At the party there were 307 men and women. If 183 were women, how many were men?

A. 490 men
B. 284 men
C. 204 men
D. 124 men

12. To build his house, Derrick needs 850 bricks. He has 645 bricks. How many more bricks does Derrick need?

A. 1,495 bricks
B. 245 bricks
C. 215 bricks
D. 205 bricks

13. Each passenger car of a train can hold 86 passengers. If a train has 9 passenger cars, how many passengers can the train hold?

A. 454 passengers
B. 534 passengers
C. 724 passengers
D. 774 passengers

14. Jack, Chad, and Eric were given a bag of candy to share. The bag had 96 pieces of candy in it. How many pieces of candy could each boy have?

A. 93 pieces of candy
B. 13 pieces of candy
C. 32 pieces of candy
D. 23 pieces of candy

15. On Thursday three kinds of sandwiches were sold at the lunchroom. Two hundred forty-three egg sandwiches were sold, 460 chicken sandwiches were sold, and 276 cheese sandwiches were sold. How many sandwiches were sold on Thursday?

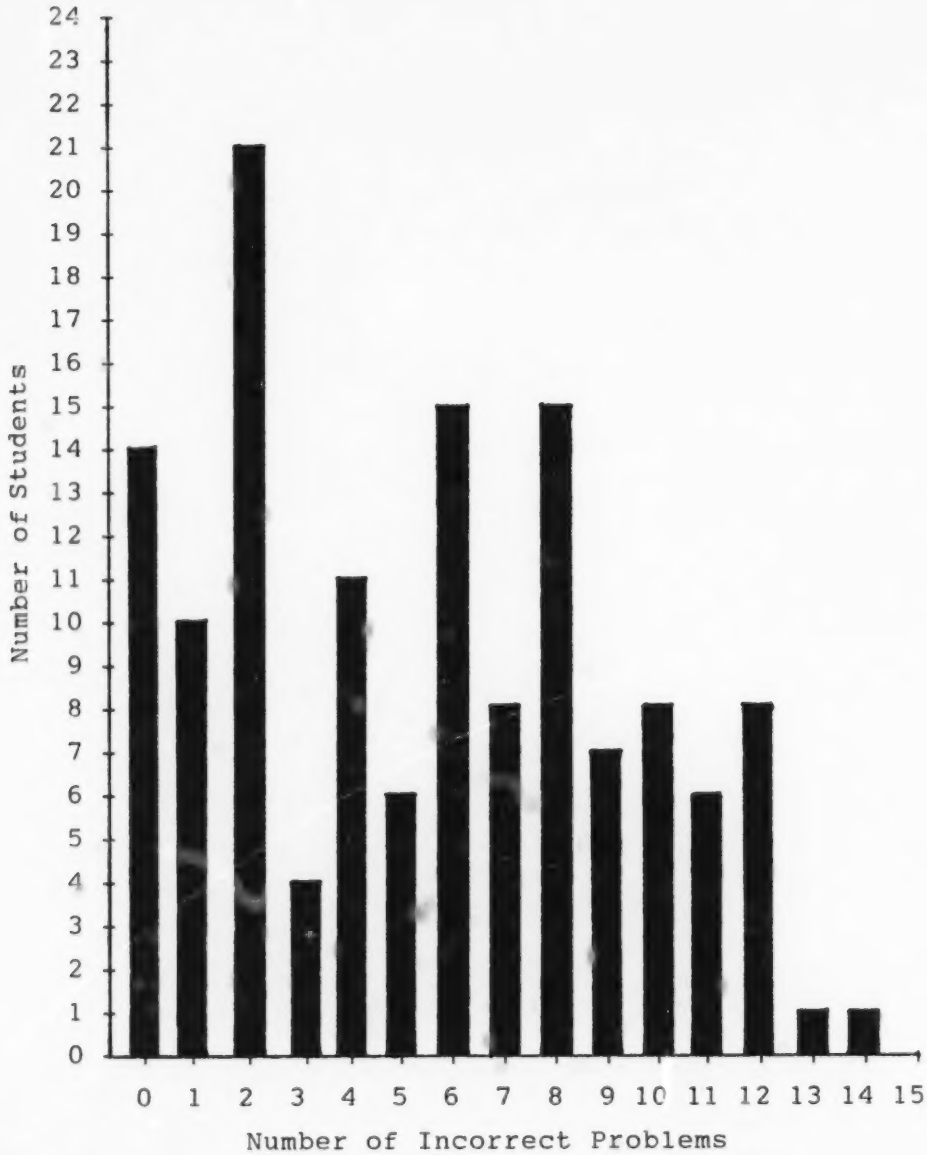
A. 870 sandwiches
B. 879 sandwiches
C. 970 sandwiches
D. 979 sandwiches

APPENDIX F

Word Problem Test Results
Pretest

APPENDIX F

WORD PROBLEM TEST RESULTS
Pretest



APPENDIX G

Fourth Grade Mathematics Scores on the
California Test of Basic Skills
for the years 1990 and 1991

Appendix G

GROUP REPORT

SCHOOL REPORT

AREA

PALM BEACH COUNTY Grade: 04 Date of Testing: 4/16/91 Test: CTBS/4 LEVEL 14 FORM A

Part 1 Group Score Summary

TESTS	ALL STUDENTS SCHL %ile	ALL STUDENTS AREA %ile	ALL STUDENTS DIST %ile	ALL EXCEPT SELECTED ESE SCHL %ile	ALL EXCEPT SELECTED ESE AREA %ile	ALL EXCEPT SELECTED ESE DIST %ile	SCHOOL PERCENTILE PROFILE ALL EXCEPT SELECTED ESE (1 5 10 30 50 70 90 95)
TOTAL READING	44	32	48	48	34	50	********48
READING COMPREHENSION	48	33	49	49	34	51	*********49
READING VOCABULARY	35	30	45	37	31	49	*******37
TOTAL MATHEMATICS	51	41	54	54	42	56	**********54
MATH CONCEPTS & APPLICATION	50	36	52	53	39	56	**********53
MATH COMPUTATION	51	45	52	55	48	55	**********55
SCIENCE	50	38	56	52	39	58	**********52
SOCIAL STUDIES	48	35	56	51	38	58	**********51

GROUP REPORT

SCHOOL REPORT

AREA

PALM BEACH COUNTY Grade: 04 Date of Testing: 4/24/90 Test: CTBS/4 LEVEL 14 FORM A

Part 1 Group Score Summary

TESTS	ALL STUDENTS SCHL %ile	ALL STUDENTS AREA %ile	ALL STUDENTS DIST %ile	ALL EXCEPT SELECTED ESE SCHL %ile	ALL EXCEPT SELECTED ESE AREA %ile	ALL EXCEPT SELECTED ESE DIST %ile	SCHOOL PERCENTILE PROFILE ALL EXCEPT SELECTED ESE (1 5 10 30 50 70 90 95)
TOTAL READING	52	39	49	54	36	51	**********54
READING COMPREHENSION	53	36	49	56	39	51	**********56
READING VOCABULARY	49	31	47	52	34	50	**********52
TOTAL MATHEMATICS	60	41	56	66	42	58	**********66
MATH CONCEPTS & APPLICATION	54	39	54	59	40	56	**********59
MATH COMPUTATION	61	47	56	64	48	58	**********64
SCIENCE	53	36	56	57	39	57	**********57

(Permission to display CTBS scores granted to the author for the purposes of this practicum by the school administrator.)

APPENDIX H

Word Problem Survey Results for the Target Group

APPENDIX H

Word Problem Survey Results for the Target Group

	Pre-Implementation	Post-Implementation
1. How do you feel about word problems?		
A. I like them	12%	44%
B. I don't have any special opinion about them	24%	36%
C. I hate them	64%	20%
2. Do you think that word problems you do at school help you to handle problems in the "real world"?		
A. Yes	20%	32%
B. Sometimes	56%	48%
C. No	24%	20%
3. Word problems are...		
A. Easy	28%	32%
B. A little hard	36%	56%
C. Very hard	36%	12%
4. I don't understand how to work word problems.		
A. True	32%	4%
B. Sometimes true	48%	64%
C. False	20%	32%

APPENDIX I

Word Problem Test Results for the Target Group Pretest

APPENDIX I

Word Problem Test Results for the Target Group Pretest

Student	Number of Incorrect Problems	Score in %	Student	Number of Incorrect Problems	Score in %
1	0	100	14	6	60
2	0	100	15	8	47
3	0	100	16	8	47
4	2	87	17	9	40
5	2	87	18	10	33
6	2	87	19	10	33
7	2	87	20	10	33
8	3	80	21	10	33
9	3	80	22	11	27
10	4	73	23	11	27
11	4	73	24	11	27
12	5	67	25	12	20
13	6	60			

APPENDIX J

Word Problem Test
Posttest

APPENDIX J

WORD PROBLEM TEST

Posttest

1. Shawn, Billy, and Tina collect rocks. Shawn has 243 rocks. Billy has 512 rocks. Tina has 106 rocks. How many rocks do they have in all?

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2. Jim took a trip. The first day he traveled 146 miles. The second day he traveled 322 miles and the third day he traveled 213 miles. How many miles did he travel in three days?

   A. 468 miles
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   A. $ 4.00
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4. A school has 758 students. If 264 students go on a field trip, how many students are still in school?

   A. 494 students
   B. 514 students
   C. 594 students
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5. There are 8 classrooms. Each classroom has 32 desks. How many desks are there in all?

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   B. 246 desks
   C. 256 desks
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   A. 889 cases
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   A. 432 points
   B. 444 points
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   C. 36 pages
   D. 13 pages

10. Jackie has a stamp collection. On each page of her book she can put 36 stamps. In her new stamp book she has filled 4 pages. How many stamps are in her new stamp book?

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    B. 144 stamps
    C. 124 stamps
    D. 114 stamps

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14. Jack, Chad, and Eric were given a bag of candy to share. The bag had 96 pieces of candy in it. How many pieces of candy could each boy have?

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    D. 23 pieces of candy

15. On Thursday three kinds of sandwiches were sold at the lunchroom. Two hundred forty-three egg sandwiches were sold, 460 chicken sandwiches were sold, and 276 cheese sandwiches were sold. How many sandwiches were sold on Thursday?

    A. 870 sandwiches
    B. 879 sandwiches
    C. 970 sandwiches
    D. 979 sandwiches

APPENDIX K

Teacher Support Letters

Seminole Trails Elementary School

4075 WILLOW POND ROAD
WEST PALM BEACH, FLORIDA 33417

55

KENNETH T. CARLTON
PRINCIPAL

DOLORES Z. CLEAVER
ASSISTANT PRINCIPAL

DAVID K. CARROLL
ASSISTANT PRINCIPAL

December 18, 1991

To Whom It May Concern:

Students in the Palm Beach County schools show a weakness on the Comprehensive Test of Basic Skills in the area of math application. The children experience problems in identifying the skills necessary to solve given situations. They are unable to organize problem-solving steps.

Any measures taken to research and offer suggestions to improve student performance in becoming better readers and stronger thinkers in problem solving is valuable.

Very Truly Yours,

Pamela V. Geddes

Pamela V. Geddes
Fourth Grade Teacher

PVG/sjm

Seminole Trails Elementary School

4075 WILLOW POND ROAD
WEST PALM BEACH, FLORIDA 33417

56

KENNETH T. CARLTON
PRINCIPAL

DOLORES Z. CLEAVER
ASSISTANT PRINCIPAL

DAVID K. CARROLL
ASSISTANT PRINCIPAL

December 18, 1991

To Whom It May Concern:

As a teacher in fourth grade, I am always alarmed by the inability of students at this level to read, interpret and correctly respond to math word problems. Given signs or directions, the children are usually successful with math at this level. If problems arise, a quick review of the skill produces success in most areas excluding word problems.

I feel that we have a problem with teaching children how to think through word problems and correctly discern the steps needed to solve the given problem. Ms. Doby's attempt at solving this dilemma could be a valuable asset to fourth graders.

Sincerely,

Joyce A. Wojtowicz

Joyce A. Wojtowicz
Fourth Grade Teacher

JAW/sjm

APPENDIX L

Letter of Permission

Seminole Trails Elementary School

4075 WILLOW POND ROAD
WEST PALM BEACH, FLORIDA 33417

58

KENNETH T. CARLTON
PRINCIPAL

DOLORES Z. CLEAVER
ASSISTANT PRINCIPAL

DAVID K. CARROLL
ASSISTANT PRINCIPAL

December 19, 1991

To Whom It May Concern:

Problem solving is an important aspect of the study of mathematics. After investigating the difficulty our fourth grade students have in successfully solving word problems, I hereby give Janice K. Doby permission to work on her Practicum Project for Nova University.

Sincerely,

Kenneth T. Carlton

Kenneth T. Carlton
Principal

KTC:at

ATTACHMENTS

Sample Student Assignments

FERRANTE'S FREAKY FRITTERS

WORKSHEET 1

Ferrante has invented a new dessert craze. He uses insects of every shape, color and size to spice up his desserts to give them a distinctive flavor. These are some of the problems he faces in running his business. Help him solve them.

1. Ferrante sold 4½ Fuzzy Fig pies and 6½ Flea and Berry pies. What was the total amount of pie sold?

2. Each Orange Bug cake costs $7.95. How much did it cost Nikita to buy 10 Orange Bug cakes?

3. Jeffrey bought nine Mosquito Burger pies. He gave Ankur 3¼ of the pies. How many pies does he have left?

4. Your mother bought some desserts from Ferrante. She spent $31.24 on Fuzzy Fig pies and $24.56 on Mosquito Burger pies. How much did she spend in all?

5. The principal treated all the teachers to Raisin Roach pie. The bill came to $17.78. How much change did he get from a $20 bill?

6. Ferrante uses 3/4 of a cup of sugar for each pie. How much sugar does it take for 12 pies?

7. Ferrante uses 30 caterpillars for the crust of each of his Crunchy Caterpillar Delights. How many crusts can he make with 960 caterpillars?

8. Ferrante uses 13½ green dragonflies in each Dragonfly pie. How many green dragonflies does he need for 20 pies?

9. D'Andre bought 7 3/4 pies. He gave 4½ pies to your class. How many pies does he have left?

10. Ferrante sold 11 Bug Berry turnovers to your teacher. Each turnover cost $2.75. How much did your teacher spend for all 11 turnovers?

11. Ferrante uses 40 jumbo-sized worms for his Wormy Apple Streudel. How many jumbo-sized worms will he need for 36 Wormy Apple Streudels?

12. Ashley gave Ferrante a $10 bill for a cake which cost $4.79. How much change did Ashley receive?

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FACTS and QUESTIONS

WORKSHEET 2A

A word problem gives some facts and asks a question.

A. The facts you need to solve the problem below are underlined. Draw a ring around the question the problem asks.

Terry has 12 toy cars. Antoine has 24 toy cars. How many cars do they have in all?

B. In each problem below, underline the facts and draw a ring around the question.

1. Mandi had $15. She spent $9. How much money does she have left?
2. How many animals does Wayne have? He has 15 rabbits, 13 cats, and 2 dogs.
3. Kettia has 14 balloons. Dustin gave her 3 more. How many balloons does she have now?
4. Natasha has 19 blue pens, 22 black pens, and 16 red pens. How many pens does she have?
5. Jeffrey gave Nicholas six candy bars. Nicholas ate two of them. How many candy bars does Nicholas have now?
6. Melissa has six dollars. She needs 21 dollars to buy a new pair of shoes. How much more money does she need?
7. Last week Matthew watched six cartoon shows, three quiz shows, and twelve mysteries. How many T.V. shows did he watch?
8. Is Amanda older than Ashley? Amanda is 23 years old. Ashley is 32 years old.

BEING REASONABLE

WORKSHEET 2B

Both the number facts and the answer to word problems should be reasonable.

A. Can you solve this problem?
Decide what number facts would be reasonable.
Fill in the facts.
Solve the problem.

Dana ate _____ apples.
Erica ate _____apples.
How many more apples did Erica eat than Dana?

B. Fill in the blanks below. Solve the problems.

PROBLEMS	WORKSPACE
1. Erick bought_____CD's at _____dollars each. How much in all did Erick pay for the CD's?	
2. Jeffrey baked_____dozen cookies. Natasha baked _____dozen cookies. How many dozen cookies did they bake in all?	
3. Dustin bought_____pencils at_____cents each. How much did the pencils cost in all?	
4. Ari had_____rabbits. He gave_____of them to Ankur. How many does he have left?	
5. Mandi spent_____cents for a pen. Angela spent_____ cents for a pen. How much more did Angela spend than Mandi?	
6. D'Andre bought_____books. Each book cost_____. How much did D'Andre spend on the books?	

Missing Numbers

WORKSHEET 2C

Fill in the blanks. Solve each problem. Label your answer.

1. Angela had 72 goldfish. She bought_____more. How many goldfish in all?

2. Matthew had_____cats. 16 cats ran away. How many cats are there now?

3. Amanda had 42 dollars. She found_____dollars. How much money does she have in all?

4. Melissa had_____dollars. She spent 14 dollars. How much change did she get?

5. Erica bought 36 ice cream bars. She ate_____of them. How many are left?

6. Dana picked 67 apples. She ate_____apples. How many are left?

7. Nicholas had 54 toy cars. He bought_____more. How many cars is this in all?

8. Nikita had_____books. She bought 3 more. How many books is this in all?

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Strange Collections

WORKSHEET 2D

Fill in the blanks. Solve each problem. Label your answers.

1. Ashley collects insects. She has_____roaches and _____green ants in a case. How many insects are in the case?

2. Ashley's friend Wayne likes insects too. His largest set contains _____spiders and_____ purple beetles. How many are in this set?

3. Sheri loves dogs. She has_____green dogs, _____pink dogs, and _____blue dogs. How many dogs does Sheri have in her collection?

4. Amanda collects stuffed animals. She has_____ lions, _____zebras, _____elephants, a tiger, a fox, a monkey, a squirrel, and a very long snake. How many stuffed animals does Amanda have?

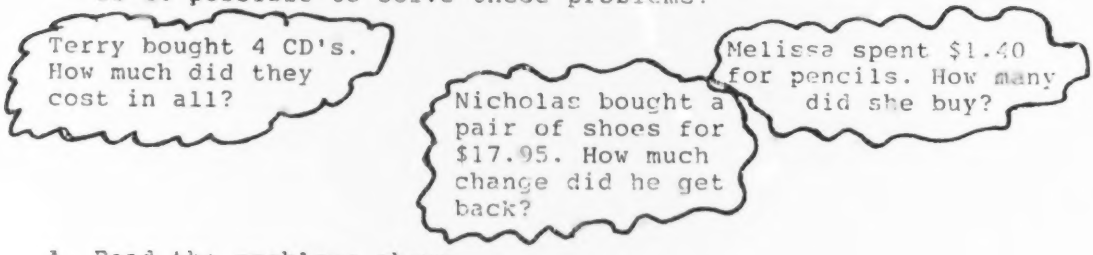
5. Kettia collects miniature toy cats and dogs. She has_____cats and_____ dogs. How many toy animals does she have in all?

6. Antoine collects unusual invisible animals. He has_____gorks, _____ mugwums, 5 plonks, and a snargel. How many invisible animals are in Antoine's collection?

What is Missing?

WORKSHEET 3A

Is it possible to solve these problems?


Terry bought 4 CD's. How much did they cost in all?
Melissa spent $1.40 for pencils. How many did she buy?
Nicholas bought a pair of shoes for $17.95. How much change did he get back?

A. Read the problems above.
   1. What information is needed to solve each of them?
   2. Make up information and then solve each problem.

B. Make up information for each problem below. Then solve the problem.

1. Erica caught an 11-inch fish. How much longer was the fish that Dana caught?

   _____

   _____

2. Apples are 49¢ per pound; bananas are 39¢ per pound. How much did Nikita spend?

   _____

   _____

3. The odometer now reads 9,362 miles. How many miles did Ashley's family travel on their trip?

   _____

   _____

4. Ari shared his cookies equally with 2 others. How many cookies did each of them get?

   _____

   _____

5. Dustin bought a new tennis racket for $14.50. Later he sold it at a garage sale. How much did he lose?

   _____

   _____

6. Big sale on fruit. Apples are 39¢ per pound; oranges are 10¢ each. How much for 5 pounds of apples and 6 pounds of oranges?

   _____

   _____

What is the Question?

WORKSHEET 3B

Remember, a word problem gives some facts and asks a question.

A. Can you solve this problem? What is missing? Write a question for the problem and then solve it.

Matthew read 25 pages of a book. Nick read 32 pages.

_____

_____

B. Write a question for each problem below and then solve the problem.

1. Erick has 15 model planes. Kettia has 12 model planes.

_____

_____

2. Jeffrey took 36 pictures on vacation. Terry took 15 pictures.

_____

_____

3. Dana earned 9 dollars on Friday and 7 dollars on Saturday.

_____

_____

4. A notebook cost 60¢. An eraser costs 35¢.

_____

_____

5. Angela spent $29 for a radio and $7 for a game.

_____

_____

6. Erica read 59 pages of a book. There are 92 pages in all in the book.

_____

_____

You Write the Problem

WORKSHEET 3C

For each problem below, write a word problem to match.

1. 22 +39 61 chairs	
2. $ 9.95 + .49 $10.44	
3. 38 -12 26 dinosaurs	
4. 48 -12 36 cupcakes	
5. 5 11 +16 32 CD's	
6. 136 -119 17 jellybeans	

WRITING WORD PROBLEMS

WORKSHEET 3D

Nicholas got 100% on his word problem lesson. His work is shown below. Write word problems that match his work in the space provided.

NICHOLAS' WORK	YOUR WORD PROBLEMS
① $8\overline{)40}$ My answer is 5 cookies.	
② $100.00 − $ 73.00 My answer is $27.00	
③ 25 × 12 My answer is 300 eggs.	
④ $7\overline{)\$8.54}$ My answer is $1.22.	
⑤ 9 × $1.98 My answer is $17.82.	
⑥ 73 + 29 My answer is 102 newspapers.	
⑦ 253 − 194 My answer is 59 miles.	
⑧ $.29 .49 .39 My answer is $1.17.	